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almost perfect?

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 10-208708

(43)Date of publication of application : 07.08.1998

(51)Int.Cl.

H01M 2/02

(21)Application number : 09-013823

(71)Applicant : YUASA CORP

(22)Date of filing : 28.01.1997

(72)Inventor : YOSHIHISA HIROYOSHI

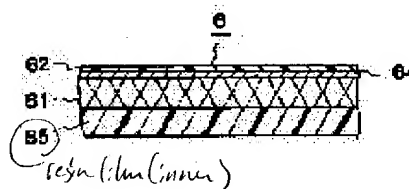
IDO SHUICHI

(54) FLAT CELL

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a flat cell which is excellent in the reliability of keeping the sealing function, and large in capacity by storing a power generation element in a package made of a laminated film in which a fusion type resin film having the prescribed tensile yield point and breaking point elongation is fused on an inner side of a metallic foil.

SOLUTION: A fusion type resin film 65 of 100-300kg/cm² in tensile yield point, 500-1000% in breaking point elongation, and 30-100μm in thickness is laminated by heat on an inner side of a metallic foil 61, and a polyethylene terephthalate film 62 of 5-20μm in thickness is laminated on the other side through an adhesive layer 64 of 5-10μm in thickness to obtain a laminate film package 6. A power generation element is stored in the package 6, and a peripheral edge part of the package 6 is fused and sealed. The dead space in a cell can be reduced, the reliability in sealability is excellent, and the durability is excellent in the use and preservation for a long time.



LEGAL STATUS

[Date of request for examination] 11.09.2000

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number] 3452172

[Date of registration] 18.07.2003

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the flat form cell by which receipt sealing was carried out into the package with which the generation-of-electrical-energy element which consists of a positive electrode, a negative electrode, a separator, and an electrolyte consists of the laminate film of a metallic foil and a resin film. Especially, it is related with the configuration of the package film.

[0002]

[Description of the Prior Art] In recent years, the miniaturization of a pocket device follows on progressing increasingly, and the demand of the formation of small lightweight is increasing also to the cell used as the power supply. Moreover, advanced features of a device follow on progressing, power consumption increases, and the demand of high-capacity-izing is increasing increasingly to the cell. Furthermore, it is in the inclination for the use of duration of service to be used several years - ten years and for a long period of time to increase, and the obturation function that the reliability which can be adapted for this is high is also demanded.

[0003] In order to fill the demand by the side of said device, in a cell, various amelioration is accomplishing with the thing of a non-theory, the material of an electrode, a separator, the electrolytic solution, etc. On the other hand, also in the package of a cell, the proposal of thin-shape-izing and lightweight-izing is proposed. One of them is changed to the package made of synthetic resin produced by the thick metal produced by the conventionally common spinning or shaping, and it has some which are going to adopt a metallic foil and a synthetic-resin film.

[0004] The cross section of drawing 4 and drawing 5 shows an example. The positive-electrode charge collector of the product [1 / 2 / a positive electrode and] for example, made from an aluminum (aluminum) foil, the negative-electrode charge collector of the product [3 / 4 / a negative electrode and] made from copper foil, and 5 are the films of the separator containing the electrolytic solution, or a solid polymer electrolyte in drawing 4. The generation-of-electrical-energy element which consists of these is contained in the package film 6. As for the package film 6, a construction material configuration in which transparency of matter, such as moisture and oxygen, does not occur through a film is selected. Generally, the laminate film of synthetic resin and a metallic foil is used. outside the mechanical strength of a package film be maintained, as showed in drawing 5, the metallic foils 61, such as aluminum, be used as the heart, in order to protect inner aluminum foil, it be rich in the strong resin 62 of mechanical strengths, such as nylon and polyethylene terephthalate (PET), and an inner surface at welding nature, such as denaturation polypropylene (PP) and polyethylene, and the resin 63 which a moisture cannot penetrate easily have be arrange, and the configuration of a laminate film 6 be paste up with said metallic foil 61 with adhesives

[0005] Moreover, the jacket wrapping material for cells with which the laminating of the olefin system resin with which the graft polymerization of aluminum foil and the alpha and beta-unsaturated carboxylic acid was carried out is carried out by direct heat welding, and it grows into JP,3-39883,Y is indicated. As it is in this proposal, in the cell which connotes the nonaqueous electrolyte containing an organic solvent, it is effective in preventing the metal of a under [a long-term activity], and exfoliation of resin to carry out direct heat weld of a metal and the resin, without using adhesives. Therefore, it is necessary to heat a metallic foil and a resin film in piles, and to laminate them. In the conventional proposal, the physical properties of aluminum foil which constitutes a package film, or resin are not specified. general -- a metallic foil -- pure -- aluminum or JIS The alloy numbers 1100 and 3003 or aluminum alloy foil of the presentation specified 3004 is used by H4160. The denaturation PE and PP to which the graft polymerization of the unsaturated carboxylic acid was carried out is used for the welding nature resin film arranged on an inner surface. Nylon and PET are regularly used by the resin film for maintaining the mechanical strength allotted outside. An outside resin film and an outside metallic foil are laminated through the binder of an urethane system.

[0006]

[Problem(s) to be Solved by the Invention] By describing the defect of the conventional package illustrated above explains the technical problem which this invention tends to solve. A cell is conventionally effective in a miniaturization and lightweight-izing in the point which can make thickness of a package small. In a certain kind of cell, for example, a lithium cell, moreover it dislikes trespass of the moisture from the outside, or oxygen extremely, the electrolytic solution must not carry out fly off toward the exterior. The package must have sufficient function which can prevent transparency of the matter between the inside of a cell, and outside. Moreover, the function required of said package must not be lost among duration of service.

[0007] When exfoliation of aluminum foil and a resin film arose or it went on further, the corrosion of aluminum foil arose, and some which pasted up the welding nature resin film arranged on aluminum foil and its inner surface through adhesives had the case where the function of a package was lost. Generally in a lithium cell, the ether, such as carbonates, diethoxy ethane (DEE), etc., such as propylene carbonate (PC) and dimethyl carbonate (DMC), constitutes the solvent of the electrolytic solution. Although the molecule of these solvents is slow, it penetrates a polyolefine film. The transmitted solvent molecule commits said binder. For this reason, exfoliation of aluminum foil and a polyolefine film arises. If exfoliation reaches the edge of a film, since aluminum will be exposed to an outer corrosive ambient atmosphere, corrosion occurs. Thus, with the film of the conventional configuration, there was a defect in which the closure function of a package is lost gradually. In order to improve this defect, said JP,3-39883,Y was proposed.

[0008] However, in the cell, the detailed crack and detailed pinhole which cannot be checked visually existed in the metallic foil of a package film conventionally, and since closure was imperfect, the poor property occurred during an activity and storage. The 1st of the

cause is generated at a closure process. In a closure process, a package film receives the spinning of the depth equivalent to the thickness of a cell. By the conventional cell, a crack and a pinhole detailed to a metallic foil occurred in 9 of the portion into which a package film bends at said closure process, i.e., drawing 4, 10, and the side portion 11 that a tension joins, and there was a problem by which closure is destroyed. like the above -- the conventional cell -- a metallic foil -- pure -- aluminum or JIS Although the alloy numbers 1100, 3003, and 3004 of H4160 were used, these were deficient in ***** and it could not be adapted for the tension in a spinning process. Conventionally, by the cell, in order to avoid this problem, thickness of a metallic foil was enlarged or the angle of bending was used as the obtuse angle like drawing 4. However, since the thickness of a package became thick or an opening like 12 of drawing 4 produced such a configuration, by the cell of the same size, content volume became small and was a thing at the sacrifice of cell capacity. Therefore, the thickness of the cell which adopted such a configuration was limited to 1-2mm or less.

[0009] It generates at the lamination process of the 2nd metallic foil and welding nature resin film of a cause. A lamination according to direct heat welding through adhesives has the large elongation of the resin film in a lamination process compared with an adhesives method. It is in the inclination for the tension which joins a metallic foil to become large, in connection with it. Breakage may occur in a metallic foil, without the ability finishing bearing this tension. Although the PP of elongation was smaller than PE as construction material of resin, in the conventional metallic foil, the case where it did not bear still arose. These breakages are detailed and a thing without the simple and leading method for inspecting the existence of breakage by the field of mass production is the actual condition. Therefore, the laminate film which is not damaged was called for.

[0010] In manufacture of this kind of cell, into a package film, it faces containing a generation-of-electrical-energy element, and a generation-of-electrical-energy element must be placed in a right location. By the conventional method, the generation-of-electrical-energy element was laid on the plane package film. For this reason, the location gap might be produced also with the trifling impact. Therefore, the method of simple positioning was searched for. The reliability of this invention which maintains an obturation function is high, and it offers a flat form cell with a big capacity.

[0011]

[Means for Solving the Problem] A laminate film which consists of a metallic foil and a resin film is used as a package film, and hauling yield stress of a welding nature resin film and a value of fracture point elongation are specified in a flat form cell which laminated a welding nature resin film and a metallic foil of an inner surface directly with heat, without using adhesives. A value of a tension which joins by this a metallic foil out of which lamination ** comes is held down within limits which a metallic foil bears, without receiving breakage. Specifically, it is JIS about yield stress of a welding nature resin film. 100-300kg/cm² and fracture point elongation are made into 500 - 1000% for yield stress by measurement specified to K6758. If both values are this within the limits, breakage will not arise in aluminum foil at a lamination process. Even if spinning with a depth of 2-3mm is added at a closure process, breakage does not arise in a resin film layer. Compared with the aforementioned range, yield stress is large, or when fracture point elongation is large, a tension which joins a metallic foil at a lamination process becomes large, and breakage arises in a metallic foil. conversely, a time of drawing being added at a closure process, when small -- a layer of a resin film -- splitting -- etc. -- breakage arises.

[0012] Let a metallic foil be aluminum alloy foil which contains Fe 0.6% or more. While this alloy foil is excellent in an adhesive property with resin, even if it receives spinning which it is rich in ***** and acute angle bending joins, neither a crack nor a pinhole generates it. Furthermore with said conventional aluminum construction material, deep drawing of impossible about 10mm depth became possible. For this reason, while a closure function of high reliability was obtained, with this kind of packaged air conditioning, a cell of a large capacity became realizable conventionally with thick [which was not able to be realized].

[0013] Let a polyolefine system resin film be PP film. This resin has small heat deformation to PE, and its elongation in a metallic foil and a process to laminate is small to it. Therefore, elongation of a metallic foil is small at a lamination process, neither a crack nor a pinhole is not only generated in a metallic foil, but dimensional accuracy is high and a film without curvature or a wrinkling is obtained. Moreover, since the adhesive property with said metallic foil is good, this invention cell is excellent [compared with PE it excels in thermal resistance, and] in thermal resistance with an elevated temperature.

[0014] Positioning of a generation-of-electrical-energy element has been attained by carrying out mold attachment to a film beforehand so that a generation-of-electrical-energy element might be restored to a package film at a field of manufacture. With a film concerning this invention, it was possible to have carried out mold attachment processing by about 10mm Fukashi, and it was effective as a means of positioning, and also a fabrication of a cell of thickness which was not able to be attained in this conventional seed cell. In the conventional cell, there was no convention about the physical properties of welding nature resin, or construction material of aluminum, and the reliability of closure was inadequate. This invention was accomplished paying attention to correlation with the physical properties of resin, construction material of aluminum, and breakage on a package produced at a lamination process and a closure process, and the reliability of closure tends to realize a cell of capacity with thick [bigger] than before highly. [0015]

[Embodiment of the Invention] (A) of drawing 1 is the cross section showing 1 operation gestalt of the flat form cell concerning this invention, and (B) is this plan for making an understanding easy. 6 is a package film in drawing 1. The material configuration of a package film is shown in drawing 2. 61 is aluminum alloy foil in drawing 2, and it is characterized by this aluminum alloy containing Fe 0.6% or more. In consideration of that there is no pinhole and satisfying reinforcement, 20-50 micrometers is suitable for thickness. 65 is welding nature resin and is specifically trade name ADOMA and MODEL. Maleic acids and acrylic acids, such as KKKU and the poly tuck, are the denaturation PP by which graft polymerization was carried out. In order to make reliability of the welding in a closure process high, 30-100 micrometers is suitable for the thickness of resin. A metallic foil 61 and welding nature resin 65 do not use adhesives, but laminate them with heat. Although the lamination by heat had the large elongation of resin and the big tension was generally added to the metallic foil compared with the lamination using adhesives, it was the combination of the high metal of ***** and the small resin of elongation, and the tension could be suppressed to the minimum and breakage generating of a metal was able to be abolished. 62 is a film with a thickness of 5-20 micrometers made from PET, and is laminated in aluminum alloy foil 61 through the adhesives 64 of an urethane system. The thickness of a glue line 64 is 5-10 micrometers. Drawing 3 is drawing showing the cross section of the package film 6 which performed former processing beforehand. The form is attached at least to the film of the method of one by the spinning between the colds so that a generation-of-electrical-energy element may be settled exactly. A location gap can be prevented by inserting a generation-of-electrical-energy element in this impression. Processing of about 10mm depth which was not able to be conventionally attained at all with the package film of this construction material is possible.

[0016] In drawing 1, a positive electrode 1, a negative electrode 3, and the generation-of-electrical-energy element that uses a separator 5 as the main component are contained in a package. 6, welding of the periphery 7 of a package is carried out, and a cell is closed. As shown

in drawing 1, although the package film 6 was about bent by the right angle in 9 and 10 by this invention cell, breakage was accepted in the metallic foil 61 and there was no ***** in it. Moreover, the breakage on metaled was not accepted in the side portion 10 of a cell, either. Since tight spinning became possible, as compared with drawing 4, the dead space 12 of a side portion can be lost like [it is ***** and]. For this reason, the effective content volume containing a generation-of-electrical-energy element was large, and cell capacity improved. Moreover, PP was excellent in thermal resistance compared with PE, and became 120-130 degrees C compared with maximum temperature having been about 100 degrees C in the case of PE, and its thermal resistance of a cell improved. In addition, 8 is the positive electrode or negative-electrode terminal which was prolonged from a positive electrode or the negative-electrode charge collectors 2 and 4, and was exposed out of the package 6.

[0017] Although an example describes the details of this invention below, there is no configuration of a configuration and a generation-of-electrical-energy element what is limited to the following examples.

(Example 1) In drawing 1, the positive electrode with a thickness of about 0.2mm with which 1 uses a cobalt acid lithium (LiCoO_2) as the main constituent, and 2 are the positive-electrode charge collectors with a thickness of about 30 micrometers made from a pure aluminum foil, and the negative electrode with a thickness of about 0.2mm with which 3 uses a carbon particle as a constituent, and 4 are the negative-electrode charge collectors with a thickness of about 20 micrometers made from copper foil. 5 -- LiPF_6 etc. -- it is a separator made from the micropore film of PP containing the nonaqueous electrolyte which dissolved lithium salt in solvents, such as PC and DMC, or PE. The solid polymer electrolyte made to dissolve lithium salt in macromolecules, such as PEO, as a separator 5 is also applicable. As shown in drawing, the layered product of a positive electrode 1, a separator 5, and a negative electrode 3 is folded up, and the generation-of-electrical-energy element whose magnitude is $42 \times 30 \text{ mm}$ and whose thickness is about 8mm is formed. This generation-of-electrical-energy element is contained by the package 6 which was shown by drawing 3 and in which mold attachment was beforehand carried out by cold working. The size of mold attachment is made equal to the size of the component of the cell connoted. 150 kg/cm^2 and the fracture point elongation of the yield stress are 700% with the heat welding nature PP film 65 the PET film 62 whose outside surface of the configuration is 10 micrometers, and whose inner surface of the thickness of the package film 6 are 50 micrometers in 100 micrometers. The heart is aluminum alloy foil 61 with a thickness of 40 micrometers whose content ratio of Fe is 1.0%. Welding of the welding nature resin of the package film of two sheets is carried out in the circumference portion 7, and a cell is sealed. Closure is performed, pressurizing with a mold from outside, or is performed under reduced pressure.

[0018] The cell of the same size as an example 1 was made as an experiment, and the ratio of Fe contained in the physical properties of the welding nature resin film which constitutes a package film, and aluminum alloy foil, and the relation of the quality of a seal were investigated. Assessment left 20 charged cells each for ten days in the temperature of 45 degrees C, and 90% of humidity RH, and made the defect what produced weight change and lowering of open circuit voltage. A table 1 is the result of investigating the relation of the defect occurrence frequency of the physical physical properties of welding nature resin, and the seal of a cell. Each core material is aluminum alloy foil which contains Fe 1.0%.

[0019]

[A table 1]

降伏点応力 (Kg/cm^2)	破断点伸び (%)	シール不良発生頻度 (個)
70	700	3
100	300	4
100	500	0
100	700	0
150	800	0
150	1000	0
150	1300	7
200	700	0
250	750	0
300	750	0
350	800	5

[0020] Yield stress is 100-300 kg/cm^2 from a table 1. And if fracture point elongation is 500 - 1000%, it turns out that a defect's generating is 0. If the physical properties of welding nature resin are within the limits of the above, this will have the small tension which joins aluminum at the time of mold attachment processing, and will be presumed for a metallic foil not to receive breakage. A table 2 shows Fe content ratio of aluminum alloy foil and the relation of the defect occurrence frequency of the seal of a cell (20 pieces) which constitute a laminate film.

[0021]

[A table 2]

Al合金中のFeの含有率 (質量%)	シール不良発生頻度 (個)
0.3	13
0.5	4
0.6	0
1.0	0
1.5	0

[0022] A table 2 shows that a defect's generating is 0, if the content of Fe is 0.6% or more. If the ratio of Fe is 0.6% or more, since it has the spread nature to which aluminum alloy foil is equal to former processing, this is presumed for a metallic foil not to receive breakage.

[0023] By carrying out the former of the package film beforehand, fixed positioning is always possible at the process which lays a generation-of-electrical-energy element in a package film. Moreover, a location gap is not produced at the process from which it moves to the seal after installation.

[0024]

[Effect of the Invention] As explained in full detail above, in the cell which packed with the laminate film, this invention makes possible that whose cell thickness was a maximum of 1-2mm conventionally to about 20mm, and can respond to a cell with a big discharge capacity. Moreover, it is effective in the dead space reduction in a cell by having made spinning of the right angle of a film possible. Moreover, the reliability of sealing-izing is high and it is equal to a long-term activity and conservation. Therefore, discharge capacity is large and the long lasting flat form cell which is excellent in thermal resistance can be offered.

[Translation done.]